

SECTION 14630 MATERIAL HANDLING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Special Terms and Conditions, apply to the work in this section.
- B. The March 2001 Preliminary Safety Analysis Report (PSAR) identifies Safety Class Components (SCC) and Safety Significant Components (SSC). Substitutions for SCC and SSC components may not be made without the proper authority. Refer to the latest PSAR or SAR for further clarification. The 50 ton High Bay Bridge Crane BC-4 is a Safety Significant Component.

1.2 SUBMITTALS

- A. Product Data
 - 1. Submit the crane manufacturer's technical data, clearance drawings, and installation instructions for the cranes.
- B. Shop Drawings, Calculations, Specifications
 - 1. Submit detailed shop drawings, calculations, and specifications, including the manufacturer's clearance drawings, prior to purchase and installation of any equipment. Shop drawings and specifications shall show complete details including runway system, bridge assembly, hoist and carrier assembly, suspension methods and locations, maximum connection reactions, wheel loads (without impact and with impact of 15% of live load), brake and motor horsepower, rpms, structural framing, details of all components, electrical and control schematics. General literature (such as advertising brochures) may augment, but shall not be accepted in lieu of shop drawings.
- C. Operation and Maintenance Manuals
 - 1. Submit complete operating and maintenance instructions, lubrication schedules, maintenance parts lists, and recommended spare parts lists for all equipment. Deliver manuals no later than 10 days prior to the time of delivery of the equipment, including electronic version of each drawing. All standard components shall be listed by the manufacturer's name and manufacturer's part number, even if the component is part of a subassembly.
- D. Certificate of Compliance
 - 1. Submit a certificate of compliance for the crane stating that design and fabrication of the crane is in accordance with applicable standards, such as CMAA No. 70. Certificate shall identify the crane by serial number.

1.3 QUALITY ASSURANCE

- A. Warrant that all work required by the specifications shall be performed in strict conformance with Federal, State, and local laws and ordinances. Provide necessary certified drawings, descriptions, and information to complete the requirements for adhering to the existing Federal, State, and local or municipal laws, ordinances, rules, and department regulations.

1.4 DELIVERY STORAGE AND HANDLING

- A. The crane shall be assembled in the manufacturer's plant in accordance with the manufacturer's standards. All parts of the crane shall be carefully matchmarked. The crane shall be taken apart only to the extent necessary for shipment. All exposed finished parts and electrical equipment shall be protected for shipment, handling, and job site storage.
- B. If practical, the equipment shall be shipped completely assembled and ready to operate when set and connected to a single available utilities source at the installation site. Where not practical, the Construction Manager shall be notified and furnished a clear description of the type and scope of assembly necessary.
- C. All parts of the equipment shall be durably and legibly marked illustrating detailed identification and match markings to enable sorting out the various parts and erecting the equipment without delay. In case separate parts are too small to mark, they shall be tagged and placed in containers plainly marked on the outside as to their contents.
- D. In shipping fasteners, care shall be taken that all the different kinds and sizes are kept separate, either in separate containers, or by partitions in the same container.
- E. A detailed packing list of all parts furnished shall be provided to permit satisfactory checking when received. When the equipment is loaded for shipment, a fax shall be sent to the Construction Manager advising name of carrier, carrier truck or car number, total routing, description of shipment, way bill number, order number, weight of heaviest piece, date of shipment, shipping point, and estimated time of arrival.
- F. As part of the drawings submitted for review, complete field assembly drawings shall be included if the equipment cannot be shipped completely assembled. The item marks of each item requiring field assembly shall correspond with the item marks on the assembly drawing. The wire numbers of all wiring connections shall correspond with the numbers on the terminal strips.

1.5 WARRANTY

- A. Provide an unlimited warranty and guaranty for two years of operation following final acceptance. During this time, replace or repair at no additional cost, any item which fails to function properly because of improper selection or application of components or as a result of defects in workmanship, material, or design.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers/suppliers offering material handling equipment including bridge cranes, hoists, monorails, and jib cranes that may be incorporated into the Work include, but are not limited to the following:
 - 1. Morris Material Handling, LLC.—Double and Single Girder Bridge Cranes, Jib Cranes
 - 2. American Crane and Engineering, Inc.—Double and Single Girder Bridge Cranes, Jib Cranes
 - 3. TC/American Monorail, Inc.—Ring Cranes and Electrified Monorails
 - 4. Cyclone/Columbus McKinnon---Chain hoists
 - 5. Coffing Hoist—Chain hoists
 - 6. Industrial Crane & Equipment Co. Inc.—Double and Single Girder Bridge Cranes, Jib Cranes, Monorails
 - 7. General Conveyor, Inc.—Ring Cranes and Electrified Monorails, Bridge Cranes

2.2 ELECTRIFIED MONORAIL SYSTEMS AND UNDERHUNG SINGLE GIRDER CRANES AND RUNWAYS

- A. Furnish all labor, materials, and services to design and fabricate the system as specified herein and as indicated on the drawings. This specification is for ring cranes BC-7, BC-8, electrified monorail MH-9, and the electrified trolley hoists for jib cranes JC-1, JC-2, JC-3.
- B. The building structure and related structural steel to which the suspended overhead track system and steel supports are to be attached are to be furnished and installed by others.
- C. General Design Criteria
 - 1. Codes and Definitions: Definitions of terms used in this specification shall be as used in the Glossary of ANSI MH27.1 as prepared by the Monorail Manufacturers Association (MMA). The latest editions of the following specifications and codes shall be conformed to the extent applicable for the application under consideration:
 - a. For underhung bridge cranes and monorail systems: ANSI B30.11 Safety Standard for Monorails and Underhung Cranes ANSI MH27.1 Specifications for Underhung Cranes and Monorail Systems. ANSI B30.16 Safety Standard for Overhead Hoists, HMI Standard (Underhung): ANSI/ASME HST-4M Performance Standards for Electric Chain Hoists, ANSI/ASME HST-4M Performance Standards for Overhead Electric Wire Rope Hoists, ANSI B30.10 Hooks.
 - b. Specifications for Design, Fabrication and Erection of Steel for Buildings of the American Institute of Steel Construction (AISC)
 - c. American Welding Society (AWS) D14.1 Specifications for Welding Industrial and Mill Cranes and D1.1 Code for Welding in Building Construction
 - d. Occupational Safety & Health Act (OSHA)
 - 2. Materials: All materials shall be new, and the completed overhead handling system shall be essentially the product of one manufacturer regularly engaged in the production of such equipment.
 - 3. Service Class: All equipment shall be designed for minimum "Class D" as specified in the ANSI MH27.1 Specifications, and operation in normal ambient temperatures (0 to 40 C) and normal indoor conditions, free from excessive dust, moisture and corrosive fumes.
 - 4. Vertical Impact: Where powered hoists are used, an impact allowance shall be included in design calculations for carriers (trolleys), cranes, and runway monorail tracks. The impact allowance shall be 1.2% of the rated load for each foot per minute (1.6% of the rated load for each meter per minute) of hoisting speed with a minimum allowance of 15% and a maximum of 50%. For bucket and magnet applications, the impact allowance shall be a minimum of 50% of the rated load.
- D. Ring Crane System Requirements:
 - 1. Layout
 - a. The system is to consist of 2 sections. Section 1 is to have a total capacity of 25 tons (2 single girder underhung cranes of 12.5 tons each) that starts at the HEBT section of the tunnel, proceeds around the north section of the ring, and ends at the RTBT. Section 2 is to have a total capacity of 15 tons (1 single girder underhung crane) that operates independently and covers the south section of the ring. The cranes are to be installed in the tunnel which is 17 feet wide by 13 feet high. Cranes are to be capable of picking and transporting equipment through the tunnel between beam line locations and the exit doorway of the HEBT or RTBT tunnels. Equipment in section 2 must be transported to the east tunnel intersection where the load can be placed on a transfer cart and moved into the section 1 craneway. Cart is NIC. The cranes

must be capable of transporting loads through a narrow aisle with right hand and left hand curves.

2. Ring Crane Features

- a. Cranes are to be equipped with chain hoists for true vertical lift. The crane hook is to approach within 4'-5" of the beamline sidewall, and within 4'-11 3/8" of the aisle sidewall. Runways are to be positioned 4'-1 7/8" from the beamline sidewall and 4'-8 5/8" from the aisle sidewall. Minimum hook height is 8'-7 1/2". Dimensions are critical to provide necessary clearances from tunnel utilities and beamline equipment.
- b. The twin 12.5 ton cranes in section 1 are to be capable of operating independently or in tandem for 25 ton loads. If operating in tandem, the cranes are to be mechanically coupled to provide fixed dimension between the hooks of 7'-6". They are to also be electrically interlocked so that both cranes can be operated simultaneously from the same pendant and /or radio controller. Pendant is to include 50 feet of cable with takeup reel.
- c. Crane control panels mounted on the bridges are to be removable with quick disconnect cables to reduce long term exposure and deterioration in a low level radioactive environment.
- d. The cranes will have dual drives on the aisle end trucks which will propel the crane down the runways and through the curves. Heavy duty thrust rollers will be used on all idler trolleys to prevent binding on the curves.
- e. When the bridge crane is transporting a load, the hook must be centered in the tunnel aisle. In this position only will multiple crane speeds be permitted. If the load is not in this position, only the slow speed will engage. When the hoist is in the beam line position, the trolley and hoist speeds will also be slow speed.
- f. Indicator lights are to be mounted on the bottom of the bridge control enclosure to indicate system status. A red light will show main power to the runways is energized, a yellow light will show the main power to the crane is energized, and a green light will show the control system has engaged.
- g. Embedded plates with studs are to be designed and furnished for attaching runway hangars. They are to be cast into the ceiling of the tunnel by others. See drawings S1.09.20, S3.10.20, and S3.10.22 for layouts and details of embedded plates. Runways are to be 6" below the embeds to run utilities across the tunnel.
- h. Conductor bars for runway electrification are to be segmented into areas so maintenance can be performed without causing interruptions of the whole system.

E. Specific Design Criteria

1. Track and Fittings

- a. The track shall be a specially fabricated section, "patented" track, with a special rolled bottom section having a raised flat tread with a minimum bottom flange width of 3/4". Bottom flange shall have a minimum ultimate tensile strength of 125,000 p.s.i with a minimum Brinell hardness of 225. Track shall be fabricated with factory prepared ends. No rough-cut ends will be permitted. Holes shall be factory punched or drilled.
- b. The track size shall be computed based on the load positioned on the track system to produce the most severe conditions of stress and deflection.
- c. The total track deflection shall not exceed L/1000 of the span.
- d. Track end stops shall be of the bolted type and shall be capable of withstanding the impact of a fully loaded crane or carrier traveling at 50% of the full load speed.
- e. Standard structural shapes or modifications of structural shapes will not be accepted as meeting the requirements of Paragraph A.1.
- f. Track sections shall be installed with bolted type splice plates to provide flush and level connections at the operating tread of the track. No welding will be

- permitted. The maximum gap between the adjacent ends at load carrying flange shall not exceed 1/16".
- g. The track shall be designed to suspend two 12.5 ton bridge cranes, fully loaded, and butted up to each other.
2. Track Suspensions
- a. All necessary clamps, hanger rods, bolts and other fittings from which the track system is suspended, shall be provided as part of the overhead track system. Track hanger supports shall be spaced as per the drawings attached or as specified.
 - b. Means shall be provided on flexible type rod suspensions to allow for minimum 1" vertical adjustment of the track both before and after the system has been put in operation so that the track can be erected and maintained level.
 - c. Where flexible type rod suspensions are used, the hanger rod shall be made from high strength steel with rolled or cut threads and furnished with a spherical washer and locking nut at each end. Each nut shall be equipped with a set screw. In addition, a roll pin shall be provided at each end of the rod to prevent the nut from backing off the rod.
 - d. Where flexible type rod suspensions are used, the top and bottom hanger fittings shall be provided with a spherical seat to match the spherical washer on the hanger rod.
 - e. Where track system is suspended by rod suspensions, the system shall be braced laterally and longitudinally. It is necessary to brace only one track laterally on flexible type rod suspensions. Both tracks shall be braced longitudinally. All bracing is to be provided by the crane erector.
 - f. Rigid suspensions can be accomplished by flush clamping or bolting the runway track direct to the support steel.
 - g. All suspension fittings shall be furnished with S.A.E. Grade 5 or ASTM A-325 mounting bolts.
3. Track Electrification
- a. Conductor bar shall be roll formed electro-galvanized steel sections, rated 100 amps continuous. Insulation cover shall be rigid bright red PVC, self-extinguishing, with an operating temperature of 150 F.
 - b. Conductors are to be complete with mounting clips, end caps, splices with covers and power feeds.
 - c. Current collectors shall be the sliding shoe type, spring loaded and so designed that sparking and loss of contact will be minimized.
 - d. Separate conductors shall be provided for each phase. More than one conductor in a single enclosure will not be permitted.
 - e. Collectors shall be spring loaded Pantograph arm mounted to a 1" square bar onto the conductor housing. Collector shall be towed to allow for maximum misalignment capability. Maximum voltage rating of collector to be 600F.
 - f. The total voltage drop shall not exceed 5 percent on runway conductor bars.
 - g. Current collector shoes shall be sliding contact type of hard copper alloy. Minimum rating shall be 35 amps. Collectors shall be mounted in tandem. Each collector shall be fully rated.
 - h. Collector leads shall be terminated in the disconnect switch, control cabinet, or in a steel junction box. Each lead shall have a separate bushed hole, and the leads shall not exceed 2 feet in length.
 - i. All conductors shall be out-bracketed using metal brackets, bottom entry style, to eliminate the possibility of dirt lodging within the enclosure.
 - j. Separate conductors shall be provided for each phase. More than one conductor in a single enclosure shall not be permitted.
 - k. Power wiring and conduit from column mounted disconnects to a junction box shall be by others. Crane Subcontractor shall furnish and install power feed taps from this junction box to the crane runway conductor.
4. Bridge Crane Electrification

- a. Festooned system consisting of multi-conductor flat cables suspended from trolleys operating on a rigid C-track mounted parallel to the bridge girder. Trolleys are to be equipped with cable saddles and clamps.
5. Control Enclosures
 - a. Enclosures shall be NEMA 12 classification or better. Enclosures shall be gasketed and include a rolled lip provided on all sides of the enclosure and around three sides of the door.
 - b. Doors shall have a continuously welded hinge. Cabinet shall be provided with a clamp cover, external mounting brackets, continuously welded seams, neoprene door gasket, print pocket on door, and fabricated from minimum 14-gage steel. Cabinets shall be furnished with white enamel finish inside.
 - c. All panels shall be assembled with UL approved components.
 - d. No openings shall be made in the enclosure except for wiring requirements. All wiring into the enclosure shall have nylon insulated connectors.
 - e. All components inside the cabinet shall be marked with black on white labels. Labels shall be securely attached to the mounting panel, and not directly on the component.
 - f. All control cabinets shall have a door interlocked disconnect switch. Bridge control panel door interlocked disconnect switches shall be designed to deenergize power and control to the cabinet being opened.
6. Wiring
 - a. Control wiring shall be red, minimum No. 16 (except for pre-wired components) and rated for 90 deg C, moisture and heat resistant thermoplastic. Wire shall be copper stranded and designed for flexing operation.
 - b. Power wiring shall be black, minimum No. 12, rated for 90 deg C, moisture and heat resistant thermoplastic. Wire shall be copper stranded and designed for flexing operation.
 - c. All wiring on the units shall be in a minimum 3/4" rigid metal conduit. The maximum number of conductors in trade sizes of conduit shall be in accordance with NEC.
7. Overload and Amperage Protection
 - a. All cranes and hoists shall have branch circuit and running overcurrent protection for each motor.
 - 1) Each motor shall have individual, automatic reset thermal overload protection.
 - 2) AC motors shall be provided with thermal overload protection in all three phases.
 - 3) All motors shall be provided with thermal overload protection embedded in the motor windings.
 - 4) Control transformer shall be provided with two fuses in primary, and fused and ground secondary.
8. Trolleys
 - a. Trolley assemblies shall be articulating type, such that, the articulated connection shall permit rotational movement in all three axes. Load bars shall be cradled in yokes in such a manner to assure that all wheels are in contact with the operating flange at all times.
 - b. Yokes shall be ductile castings, forgings, or steel fabrications and shall be fixture machined.
 - c. Design shall be such to facilitate easy installation or removal of wheels at any point along the track system without removing the carrier assembly from the track.
 - d. Trolley wheels shall be made from high strength forged or machined steel, 5" minimum tread diameter. The wheel tread shall be accurately machined to assure concentricity of axle and tread, and hardened to 425 Brinell. Wheels are to be furnished with electro-plate finish, black oxide, or equal treatment, in lieu of paint.

- e. Wheel bearings shall be double row precision ball or taper roller bearings, lubricated and sealed at assembly, and fitted with external grease fittings. Bearings must have a minimum B-10 life of 5,000 hours.
 - f. Flangeless wheels with side guide rollers may be provided in lieu of flanged wheels.
9. Crane Bridges
- a. Bridges shall be single girder.
 - b. The loadings shall be computed with all loads positioned on the crane to produce the most severe conditions of stresses and deflection. The total bridge deflection shall not exceed $L/1000$.
 - c. Bridge girder shall be properly aligned and rigidly attached to the end trucks and properly mounted with fasteners to prevent distortion or racking.
 - d. A 3-inch minimum clearance shall be maintained between various building structures, lights, pipes, sprinklers, and other obstructions.
 - e. Supplier shall furnish and install placards with bridge capacity and serial number on both sides of bridge beam. Letters shall be a minimum of 4 inches tall.
10. Crane Drives
- a. The motor operated bridge drives shall consist of the following design: One variable frequency drive consisting of a 3 phase, 460 volt, AC, 4 quadrant digital programmable speed controller and motor with a fully enclosed oil splash lubricated spur gear reducer and an adjustable brake with maintenance override. All drives shall be Electromotive, three step with speeds of 2.5, 10, and 25 fpm under full load. All speeds to be plus or minus 2 percent.
 - b. All bearings shall be the anti-friction type, and shall be selected for a minimum of 5,000 hours "L" life expectancy, based on the full rated speed and full load carrying capacity. All bearings shall be of standard dimensions, tolerances, and fits as specified in AFBMA-ANSI standards.
 - c. The drive shall be designed to provide smooth, adjustable deceleration and acceleration from standstill to full speed.
 - d. All gears shall meet the requirements of the AGMA specifications for strength and durability, based upon the maximum loads. All gearing shall run in an oil bath or be splash lubricated. All gearing shall be minimum Class II.
11. Bridge Drive Motors
- a. The crane drive motors shall have a continuous operating rating of sixty minutes at 100 percent rated torque from 100 percent of base speed. Maximum temperature shall be 55 deg C above the 50 deg C ambient temperature. Insulation shall be a minimum Class F as defined by NEMA Standard MG-1, "Motors and Generators". Bridge motors shall be TENV.
 - b. Motor overload capacity shall be 200 percent of base speed for one minute.
 - c. All crane drives shall be equipped with an adjustable disc type motor brake.
 - d. All motors shall be designed with a minimum of 1.15 service factor.
12. Controls
- a. Controls shall be housed in a NEMA 12 enclosure for protection against dust and moisture.
 - b. A fused manual disconnect switch, housed in a NEMA 12 enclosure, with a lockable handle shall be provided and wired into the incoming circuit from the runway power collectors.
 - c. A magnetic mainline contactor is to be provided and operated from the pushbutton station.
 - d. All motor starters shall be adequately sized for crane duty consistent with horsepower requirements and shall be of the reversing type, fully magnetic, with mechanical and electrical interlocks.
 - e. Each motor shall be provided with thermal overload protection.
 - f. Fusing shall be provided on the secondary side of the control circuit transformer.

- g. A means for controlling acceleration must be provided. Across the line starting is not acceptable.
 - h. The complete control panel is to be factory mounted and wired. All wires within the panel are to be marked and terminated on numbered terminal strips.
 - i. All wiring shall be in rigid conduit wherever possible. Flexible cable may be used on short runs where rigid conduit is not practical.
 - j. Radio control systems shall be a frequencies licensed system. All transmitters shall be universal, have coded plug sockets, and color specific to each crane. All transmitters shall be belly box type with shoulder harnesses. One set of spare battery packs and a charger for each transmitter is required.
13. Hoists
- a. Hoists and appurtenances shall be designed to withstand all stresses imposed under safe operating conditions while handling loads within the rated capacity. Load bearing parts shall be designed such that the static stress, calculated for rated load, shall not exceed 20% of the ultimate strength of the material.
 - b. Hoists are to be furnished complete with a suitable pushbutton control station. Pushbutton arrangement is to be supplied with strain relief protection. Control actuators shall be dead-man type with speed adjustment of multi- speed control obtainable by progressive depression of the pushbutton elements to increase motor lift speed and spring return to off position.
 - c. The braking system shall be capable under normal operating conditions with rated load to stop and hold the load when controls are released. Controlled lowering shall be limited to 120% of rated lowering speed. In the event of complete power failure, the load shall be stopped and held.
 - d. All bearings shall be heavy duty, anti-friction type with a minimum B10 life of 5,000 hours. Motor bearings shall be lifetime lubricated, sealed ball bearings.
 - e. All gearing shall be forged heat treated alloy steel machined for smooth quiet operation. All gearing must meet AGMA quality specifications.
 - f. Bottom block shall be completely shrouded for safety and fabricated from steel. Sheaves must be forged or rolled steel, running on anti-friction bearings. Hooks are to be forged steel supported by anti-friction thrust bearings and permit 360 rotation. Hooks shall be equipped with latches unless the application makes the use of the latch impractical. When required, a latch shall be provided to bridge the opening of the hook for the purpose of retaining slings, chains, etc., under slack conditions.
 - g. Motors shall be totally enclosed, specifically designed for hoist service capable of starting and operating under any condition within the designed capacity and provided with thermal overload protection.
 - h. Each hoist shall incorporate an upper plugging type limit switch automatically stopping the hoist motion when the block reaches its highest position. Excessive hook drift shall cause the block to be momentarily reversed.
 - i. Electric hoist controls shall comply with N.E.C. requirements for the application being considered and shall include control circuit fusing and contactors mechanically and electrically interlocked.
 - j. All hoist carriers shall be furnished with travel brakes. The electric motor brakes shall be direct acting, self-adjusting, magnet operated and spring set multiple disc type, capable of automatically stopping the motor rotation in either direction when the motor is de-energized. The electric brake must be totally enclosed, dustproof and weatherproof, designed for a low braking pressure not to exceed 3.5 psi, with short stroke positive action minimizing drift.
 - k. Hoist carriers shall be provided with safety lugs to limit the drop of the carrier assembly to one inch or less in the event of wheel or axle failure. The safety lugs shall be placed on both sides of the rail so that, if failure occurs, the rail is centrally loaded about the vertical axis. Carrier load bearing parts shall be designed utilizing a minimum safety factor of five, based upon the minimum ultimate strength of the materials.

14. Assembly and Test
 - a. Equipment shall be factory assembled, and a no load running test of controls and drive machinery to ensure proper operation shall be performed. The units will be disassembled only as necessary for shipment.
15. System Marking
 - a. All major components of the system shall be marked at the factory so as to assure prompt and proper field identification.
16. Painting
 - a. All material shall be cleaned of loose rust, mill scale and foreign matter.
 - b. Hoists, trolleys, runways and suspension fittings shall be painted one shop coat of manufacturer's standard finish. Construction Manager shall select color.
 - c. Equipment must be adequately protected against damage and rust in shipment.
17. Manufacturer's Drawings and Data
 - a. General Arrangement Drawings: Drawings showing plan, elevation and sectional views along with all other pertinent data shall be provided by the Supplier.
 - b. Panel Layout and Schematic Wiring Diagrams: Complete wiring diagrams shall be provided, showing all electrical devices, numbered terminal strips and wiring.
18. Spare Parts and Maintenance Manuals
 - a. Supplier shall furnish ten (10) complete copies of the Parts Operation & Maintenance Manual for the equipment after shipment. These manuals are to include key component breakaway pictures for ease of parts ordering, catalog cut pages, part numbers, sub- assembly details, and periodic inspection and maintenance requirements recommendations.

2.3 TOP RUNNING BRIDGE CRANE SYSTEMS

- A. Furnish all labor materials, and services to design and fabricate the system as specified herein and as indicated on the drawings. This specification is for top running bridge cranes BC-1, BC-2, BC-3, BC-4, BC-5, BC-6, and BC-9.
- B. The building structure and related structural steel including the crane runways and ASCE rails and their supports are to be furnished and installed by others.
- C. General Design Criteria
 1. The crane shall be manufactured by a company that has been engaged in the manufacture of overhead bridge cranes for a minimum of 10 years. The company shall also be a member in good standing of the Crane Manufacturers Association of America (CMAA)
 2. All cranes shall be manufactured in accordance with current mandatory requirements of the National Safety and Health Act, OSHA Section 1910.179 and 1910.309 as applicable to double and single girder cranes.
 3. Additionally, all cranes are to be manufactured in accordance with the appropriate standard of ANSI specifications, the National Electric Code, and the Crane Manufacturers of America (CMAA) specifications. **Special exception: The 50 ton High Bay crane (BC-4) in the Target Building is to be designed, fabricated, and installed per ASME NOG 1, Class 2. Where requirements conflict between NOG-1 and this specification, NOG-1 requirements shall take precedence.**
 4. Cranes are to be furnished as shown in the drawings and schedules. Cranes are to be furnished for Service Class "D" duty. Relationships of hook heights, clear heights under steel, and crane rail elevations are shown on the drawings.
 5. All cranes are to be equipped with variable speed drives for bridge, trolley, and hoist motors to permit creep speeds for setting and positioning precision equipment.

6. 30 ton Cranes BC-2 and BC-3 are to be equipped with special extendable javelin booms (one each) of 5 ton capacity to reach into the chopper shelf area that lies outside the normal hook approach of the 30 ton hoist.

D. Bridge Crane System Requirements

1. Crane Bridge Girders
 - a. All crane girders are to be computer designed A-36 structural steel beams reinforced as necessary or fabricated plate box sections.
 - b. Bridge girder to end truck connections are to be designed for all loadings, stresses and stability in accordance with current CMAA design specifications for the appropriated designated class of crane purchased. Gusset and wing plate connections are to utilize high strength A-325 bolts. Critical alignments are to be assured during the manufacturing process.
2. Electric Bridge Drives
 - a. All crane drive units are totally enclosed. Gear material shall be SAE 8620 drop forgings with a gear finish to AGMA Class 12. Gear hardness shall be 58-62 Rc minimum.
 - b. Rotating axle units utilize all helical gearing running in an oil bath.
 - c. Fixed axle units are as above except final low speed spur gear reduction is to be provided. This combination is to be used along with a gear rim wheel arrangement.
 - d. All bridge drive arrangements are A-4 dual drive.
 - e. All gearbox/drive arrangements are heavy duty industrial crane rated for service class "C".
 - f. Crane wheels are to be high quality machined true double or single flanged wheels as applicable and designed to provide long trouble free life.
3. Bridge Drive End Trucks and Wheel Assemblies
 - a. Bridge trucks are to be constructed of square box structural tubing or welded structural shapes forming a rigid box section.
 - b. Wheels are to be double flanged with crane rated hardness suitable for maximum wheel loading in accordance with CMAA specifications.
 - c. Wheels shall rotate on rotating axles or about fixed axles. All bearings shall be high quality precision anti-friction bearings.
 - d. All trucks are to be provided with rail sweeps to meet or exceed safety standards. Crane trucks are designed to limit drop to less than 1/2" in the event of an axle failure.
 - e. Suitable rubber, polyurethane or spring bumpers shall be provided on all contact corners of bridge trucks and aligned to contact crane stops on the runway rails, and shall be designed, sized, and mounted as required by OSHA.
 - f. Crane BC-4 is to be equipped with seismic restraints to keep bridge on the runways in the event of earthquake.
4. Motors
 - a. All motors shall be crane and hoist duty, squirrel cage, TENV or TEFC, with Class F insulation. Standard motors use terminal strip connectors. Bimetallic thermal overloads providing over current and under voltage protection are to be provided.
5. Electric Controls
 - a. Crane control enclosures are to meet NEMA 1 and pendant enclosures shall meet NEMA 1, 3R, and 12 as standard.
6. Crane Operator Stations
 - a. A durable shock resistant pendant station shall be suspended from a bridge mounted galvanized roller track festoon system. This is to allow operator freedom and positioning independent of the hoist/trolley or load position. 110 volts single pole phased current is to be provided to the operator station. In addition to internal electrical grounding of the P.B. frame, a common external

- ground drop chain reliever is to be provided. The pendant is to be equipped with a magnetically operated main line contactor on/off switch allowing switching of line currents to the motor starter controls. All stop buttons are red in color.
- b. The 30 ton and 50 ton cranes (BC-2, BC-3, BC-4) and the 10 ton crane in 2TU (BC-5) are to be radio controlled. Radio control systems shall be a frequencies licensed system. All transmitters shall be universal, have coded plug sockets, and color specific to each crane. All transmitters shall be belly box type with shoulder harnesses. One set of spare battery packs and a charger for each transmitter is required.
- 7. Brakes
 - a. Hoist brake shall be positive rotor mounted conical type.
 - b. Bridge and trolley brakes shall be "electronically controlled" DC disc brakes based on the fail-safe circuit principle. Brake linings are to be self cleaning for long life and reliable operation. Brake coils are epoxy impregnated and bonded to a cast iron body.
 - 8. Safety Enclosed Bridge Conductor Electrification
 - a. Bridge/trolley festoon systems are to be provided on a galvanized steel roller track system using 4 wheel track mounted carriers operating on sealed anti-friction bearings. Cabling is to be extra-flexible high quality flat cable drop loops comprising of a festoon system mounted on fixed radius saddles. A trolley tow arm and tow chain is connected to the lead trolley to exert tow force in line with the conductor system.
 - 9. Main Current Crane Pickup Collectors
 - a. Spring loaded collectors shall be provided for a 3 pole safety type conductor system such as Safe-T-Bar, Insult-8, or approved substitute. Collector contact surfaces are to be furnished with replaceable inserts.
 - 10. Hoist/Trolley Units
 - a. Hoist motors are to be heavy duty flange mounted type with TENV enclosures and Class F insulation. The hoist motor shall be designed with a NEMA D torque curve to allow heavy inertia starting with a high slip. Motor bearings are to be double shielded ball type, lubricated and sealed for life. The hoist motor disc brake is to be rated at 150% of full load motor torque.
 - b. An adjustable upper and lower hook elevation limit switch device is to be provided.
 - c. A rope cable guide is to be provided so that the hoisting cable is coiled on and off the drum properly during hoisting and lowering applications.
 - d. Hoist alloy steel gearing is to be quiet helical or helical spur running in oil bath lubrication. All bearings are to be anti-friction type. Convenient oil level dip sticks or check ports are to be provided.
 - e. Hoist drums are to be fabricated steel tube with full depth machine grooving supported by large roller bearings.
 - f. Hoist/Trolley frames are to be precision fabricated steel weldments.
 - g. Trolley drive is to consist of 2 of 4 wheels driven via a totally enclosed motor and reducer coupled to final drive wheels or cross shafting. All high speed gearing shall operate in an oil bath.
 - h. Trolley bumpers shall be spring type and designed, sized, and mounted as required by OSHA. Bumpers shall be mounted to prevent direct shear on bolts.
 - i. Crane shall have hoists with two-part, double reeving for true vertical lifts and precise, accurate positioning of loads.
 - j. Drum design shall provide not less than two complete wraps of hoisting rope remaining in the grooves when the hook is at the lowest position for the lift specified and shall not require overlapping of the rope when the hook is at its highest point.

- k. The pitch diameter of the drum shall not be less than 18 times the rope diameter when 6x37 rope is furnished or 24 times the rope diameter when 6x19 rope is furnished.
- 11. Hook Block and Hoist Wire Rope
 - a. All crane hooks are to be forged steel and equipped with a safety latch with a spring return.
 - b. The hook block is to be a semi-enclosed steel weldment with the bottom sheave assemblies sized per CMAA service class requirements. The hook shall be supported on a 360° anti-friction trust bearing allowing easy rotation of lifted loads.
 - c. All wire rope is to be crane & hoist duty rated, sized and arranged to provide a 5:1 min. safety factor in accordance with CMAA specifications.
 - d. Crane BC-4, (50 ton High Bay Crane in Target Building) is to include a single "J" hook with power rotator.
 - e. Hoisting ropes shall be of proper design and construction for crane service. Improved plow steel wire rope shall be used for design purposes. The rated capacity load plus the bottom block divided by the number of parts of rope shall not exceed 20 percent of the published breaking strength of the rope.
 - f. The pitch diameter of the running sheaves shall not be less than 18 times the rope diameter when 6x37 rope is furnished or 24 times the rope diameter when 6x19 rope is furnished. The pitch diameter of idler sheaves shall not be less than half the diameter of running sheaves.
- 12. Extendable Booms (Javelin Cranes) for 30 Ton Cranes
 - a. A mechanical extendable/retractable boom with 5 ton capacity hoist is required for each of the 30 Ton bridge cranes BC-2 and BC-3.
 - b. The Javelin boom is to be mounted on a motorized trolley that moves along the lower flange of one of the crane girders. If box beam girders are provided, lower flanges will be necessary to support the javelin boom.
 - c. The 5 ton hook is to be capable of approaching within 6 inches of the cylindrical wall of the monolith located at the center of the Target Building. This is necessary to place or pick loads setting adjacent to the monolith wall over the chopper shelf. This may require that the hoist be mounted in a fixed position under the crane and the wire rope cable fed over a pulley at the end of the boom to minimize hook approach. A weighted hook ball will be required for lowering the hook when not loaded.
 - d. The boom is to be designed so that the hook can reach any distance up to a maximum of 10'-6" beyond the crane rail as measured perpendicular with the rail.
 - e. The javelin boom mechanism is to be mounted to the underneath side of the bridge crane and is to be an integral feature or accessory with the crane. The boom mechanism is to be designed so that the 30 ton hook approach at the Column lines E and G are not restricted.
 - f. Boom extend/retract speed is to be variable from 0 to 20 feet/minute, and hoist speed is to be variable from 0 to 15 feet/minute.
 - g. Boom is to be parallel with the bridge crane, and is not to be capable of swinging like a jib crane. The boom must be fully retractable to a "home" position and secured to the bridge crane when not in use, and must not interfere with normal bridge crane operations.
 - h. Safety interlock is to be provided to prevent operator error that may cause the boom to impact the monolith. This can be performed by a laser proximity control or other method that will shut down the boom extend motion if it is too close to the monolith structure.
 - i. Hook height is to be a minimum of 20 feet. Javelin boom is to be designed so that it does not interfere with the Jib Cranes JC-3 mounted on the wall of the target monolith or the ceiling of the shine shield over the chopper shelf.

- j. Boom retract/extend and hoist controls are to be included in the crane radio controller and the backup pendant controller.
 - k. Safety interlock is to be provided that prevents the bridge crane from operating while the extendable boom is out of its "home" position. Once a load is picked and retracted to a "home" position, the bridge crane can be operated normally, even if a 5 ton load is on the hook.
 - l. Hoist and feeding mechanism on boom is to be designed to permit true vertical lift.
 - m. Boom must be rigid to minimize deflection during hoisting operations at furthest extent.
13. Painting
- a. All painted surfaces shall receive proper metal preparation and cleaning prior to paint application. As a minimum, SSPC SP3 is acceptable to ensure good paint adhesion. A rust inhibiting chromatic free primer coat shall be applied to an average drift film thickness (DFT) of 1.5 to 2.0 mils. This shall be followed by a finish coat of lead free oil base industrial enamel applied to a DFT of 1.0 to 1.5 mils. Finish color will be safety yellow for crane bridge unit and manufacturer's standard color for trolley unit thus providing good trolley positioning contrast.
14. Miscellaneous
- a. Ten (10) maintenance and repair manuals are required
 - b. Crane catwalks mounted on the bridges and under-crane lighting are to be provided for cranes BC-2, BC-3, BC-4.
15. Final Factory Inspection and Run Testing
- a. All motor, control and drive equipment shall be operationally no load power run tested upon completion of manufacture. Factory run test/check reports are to be completed to insure manufacturing compliance.

2.4 MANUAL CHAIN HOISTS WITH MANUAL TROLLEYS (MH-1, MH-2, MH-3, MH-4)

A. General

- 1. Furnish and install manual chain hoists with manual trolleys for monorails located in drawings and described in schedule.
- 2. Each hoist is to have minimum capacity and hook height as specified in the schedule.
- 3. Provide manual chain driven gear trolleys.
- 4. Load brake is to include a 6-tooth holding pawl that engages a 24-tooth holding ratchet at six points simultaneously.
- 5. Provide load limiter to prevent overloading.
- 6. Aluminum die cast hand chain guide and cover is required to prevent jamming of the hand chain.
- 7. Load sheave is to be forged alloy steel.
- 8. Chain pockets are to be precision machined for accurate fit of load chain.
- 9. Bearings are to be lifetime lubricated.
- 10. Chain pull to lift load is not to exceed 75 pounds or as indicated on schedule.
- 11. Load chain is to be case hardened alloy steel
- 12. Monorail track (S10) is to be furnished and installed by others.

2.5 JIB CRANE

A. General

- 1. Furnish and install jib cranes as shown on the drawings and as specified in the schedule.
- 2. Jib cranes of the wall bracket type are to have 200 degree rotation capability.
- 3. Jib cranes that are free standing are to be base plate mounted.
- 4. Furnish and install manual rotation stops to stop the swinging boom.
- 5. Furnish and install trolley end stops on the boom.

6. Bearings are to be incorporated into the bracket or mast/boom connection so that the boom rotates freely, yet does not drift when at rest.
7. Jib crane JC-3 is to include a power rotator for the boom with controls on pendant.
8. Jib cranes JC-1, -2, -3 are to include festoon type electrification for the trolley and hoist.

2.6 SCHEDULE

Material Handling Equipment Schedule Specification No. 14630

Item No.	Description	Qty	Location	Minimum Capacity (tons)	Hook Ht. (feet)	Span (feet)	Chain Pull (lbs)	Jib Crane Support	Dwg. Ref.
MH-1	Monorail Chain Hoist--Manual	1	Central Utility Bldg	2	16	Not Applicable	75	Not Applicable	A2.01.71
MH-2	Monorail Chain Hoist--Manual	1	Central Utility Bldg	2	16	Not Applicable	75	Not Applicable	A2.01.71
MH-3	Monorail Chain Hoist--Manual	1	Central Utility Bldg	2	16	Not Applicable	75	Not Applicable	A2.01.71
MH-4	Monorail Chain Hoist--Manual	1	Central Utility Bldg	2	16	Not Applicable	75	Not Applicable	A2.01.71
MH-5	Deleted								
MH-6	Deleted								
MH-7	Deleted								
MH-8	Deleted								
MH-9	Monorail Chain Hoist--Electric	1	CHL/RF Bldg	8	26	Not Applicable	Not Applicable	Not Applicable	A2.01.79
MH-10	Deleted								
MH-11	Deleted								
BC-1	Bridge Crane-Top Running	1	CHL Bldg	7.5	21	55	Not Applicable	Not Applicable	A2.01.78
BC-2	Bridge Crane-Top Running	1	Target Bldg	30	30	80	Not Applicable	Not Applicable	A3.30.31
BC-3	Bridge Crane-Top Running	1	Target Bldg	30	30	80	Not Applicable	Not Applicable	A3.30.31
BC-4	Bridge Crane-Top Running	1	Target Bldg	50	80	40	Not Applicable	Not Applicable	A3.30.31
BC-5	Bridge Crane-Top Running	1	2TU	10	25	50	Not Applicable	Not Applicable	A3.20.33
BC-6	Bridge Crane-Top Running	1	2TU	5	15	20	Not Applicable	Not Applicable	A3.20.33
BC-7	Bridge Crane-Underhung	2	Ring Tunnel	12.5	8'-7 1/2"	10'-7 5/8"	Not Applicable	Not Applicable	A3.30.20
BC-8	Bridge Crane-Underhung	1	Ring Tunnel	15	8'-7 1/2"	10'-7 5/8"	Not Applicable	Not Applicable	A3.30.20
BC-9	Bridge Crane-Top Running	1	11TU	10	32	60	Not Applicable	Not Applicable	A3.20.34
JC-1	Electric Trolley Hoist on Jib Crane	1	Central Utility Bldg	2	22	8	Not Applicable	Wall bracket	A2.01.72
JC-2	Electric Trolley Hoist on Jib Crane	1	CHL Bldg	0.5	10	15	Not Applicable	Free Standing	A2.01.77
JC-3	Electric Trolley Hoist on Jib Crane	2	Target Bldg	10	20	20	Not Applicable	Cantilever w/power rotater	A2.02.42

Supplementary Requirements

Item No.	Description	Electrification	Max. Travel Speeds (FPM) Variable Bridge	Trolley	Hoist	Crane Spec.	Hoist
BC-1	Bridge Crane-Dble Girder, Top Running	Shielded Bar Conduct.	60	60	15	CMAA #70-1994	Wire Rope
BC-2	Bridge Crane-Dble Girder, Top Running	Shielded Bar Conduct.	60	60	15	CMAA #70-1994	Wire Rope
BC-3	Bridge Crane-Dble Girder, Top Running	Shielded Bar Conduct.	60	60	15	CMAA #70-1994	Wire Rope
BC-4	Bridge Crane-Dble Girder, Top Running	Shielded Bar Conduct.	60	60	15	ASME NOG 1, Class 2	Wire Rope
BC-5	Bridge Crane-Dble Girder, Top Running	Shielded Bar Conduct.	60	60	15	CMAA #70-1994	Wire Rope
BC-6	Bridge Crane-Single Girder, Top Running	Shielded Bar Conduct.	60	60	15	CMAA#70-1994	Wire Rope
BC-7	Bridge Crane-Single Girder, Underhung	Shielded Bar Conduct.	25	20	2	ANSI MH 27.1	Chain
BC-8	Bridge Crane-Single Girder, Underhung	Shielded Bar Conduct.	25	20	2	ANSI MH 27.1	Chain
BC-9	Bridge Crane-Dble Girder, Top Running	Shielded Bar Conduct.	60	60	15	CMAA#70-1994	Wire Rope
JC-1	Jib Crane-Electric Chain Hoist Underhung	Shielded Bar Conduct.	Not Applicable	30	15	ANSI MH 27.1	Chain
JC-2	Jib Crane-Electric Chain Hoist Underhung	Shielded Bar Conduct.	Not Applicable	30	15	ANSI MH 27.1	Chain
JC-3	Jib Crane—Electric Chain Hoist Underhung	Shielded Bar Conduct.	Not Applicable	30	15	ANSI MH 27.1	Chain
MH-9	Monorail—Electric Chain Hoist	Shielded Bar Conduct.	Not Applicable	20	15	ANSI MH 27.1	Chain

PART 3 - EXECUTION:

3.1 EXAMINATION

- A. Examine areas and conditions under which the work is to be installed, and notify the Construction Manager in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 ERECTION AND INSTALLATION

- A. The cranes and hoists shall be erected and installed, complete and in condition to perform the operational and acceptance tests.

3.3 ERECTION SERVICES

- A. The manufacturer shall provide supervisory erection services.

3.4 FIELD INSPECTION AND TESTS

- A. Pre-erection Inspection: Before erection, the contractor and the manufacturer's representative shall jointly inspect the crane bridge and hoist systems, jib cranes, and/or monorails and components at the job site to determine compliance with specifications and manufacturer's data and shop drawings. The Contractor shall notify the Construction Manager 10 days before inspection.
- B. Runway Alignment: The Contractor shall verify and adjust the crane runway alignment as necessary to ensure that the runway is level and that the span is accurate and parallel along the full length, and that the runway is nonskewed within the building. The curved sections of runway in the Ring Tunnel are to be level and uniformly curved to within 1/8 inch. Embedded plates in the roof of the Ring Tunnel are provided for hangar attachment.
- C. Operational Inspection and Tests: Upon completion and before final acceptance, the contractor shall perform the operational tests and load tests specified in the applicable ANSI B30 safety standards, except that test loads shall be in increments of 50, 100, and 125 percent of rated load. Rated speeds (with 100 percent test loads) shall be in accordance with the specification. The Contractor shall demonstrate proper operation of controls and safety devices. The Contractor shall provide operating personnel, instruments, and all other necessary apparatus. The Contractor shall provide written notification to the Construction Manager not less than 30 days before testing. The Contractor shall furnish loads for testing.
- D. Training: Training in three disciplines at various levels shall be provided for maximum of ten people in each class: mechanical maintenance, electrical maintenance, operation. Operation training shall be detailed enough to ensure the operator a conceptual knowledge of the equipment as well as the actual hands-on experience of the workings of the system in their everyday environment. Mechanical and electrical maintenance will be detailed enough to enable the repair and maintenance of all components and subsystems. Lessons in safety, preventive maintenance, theory of operation, adjustment procedures, and troubleshooting will be included. Owner will supply classrooms and audio-visual equipment for on-site training. A complete set of all training documents and course aids shall be furnished at a minimum of thirty days prior to the scheduled commencement of training for review and approval.

END OF SECTION 14630